

SHORE POWER

Emissions Reduction Alternative
for Ships Docked in Port

November 9, 2004

California
Air Resources Board



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DOCK WATTS LLC

THE NEED



- Ship emissions are one of the largest uncontrolled sources of pollutants.
- On-board ship electric generation accounts for more than 20 % of in-port emissions.
- Natural gas fueled power plants produces less than 1/2 % of emissions per MWh compared to ship on-board generators.
- Shore Power (a.k.a. “cold ironing”) virtually eliminates emissions from ship auxiliary engines while ships are berthed in a port.

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WHY NOW



- Port growth is essential for economic growth.
- Air emissions cause significant health and respiratory problems, impacting communities around ports.
- Ports need to mitigate environmental impacts to surrounding communities.
- Shore power is proven technology that can be implemented immediately.

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DOCK WATTS LLC



MISSION: Advance use of shore power for ocean going vessels by demonstrating technical and commercial viability.

VISION:

Provide out sourced services to develop shore power facilities.

Provide project management and operations management of shore power facilities.

Provide energy management and utility advice to ports, terminal operators, and ship operators.

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DOCK WATTS TEAM

Over 100 yrs of Experience & Performance



Robert D. Hoffman, President and Founder

- 23 years experience in the utility, independent power, and deregulated energy industries
- Former Executive at New Energy Ventures, Former Senior Developer at AES and Edison Mission Energy
- Experienced in power generation, utility operations, commercial structuring, and financial analysis

• Bob Maddison, Vice President, Operations

- 19 years experience in ship engineering and Naval Architecture
- Former Manager for Princess Cruise Ltd., project managed shore power facility in Juneau, Alaska

• Charles B. McCarthy, Board Member

- Former Sr. Vice President (Operations) at Southern California Edison, including 2 years as Site Manager at San Onofre Nuclear Generating Station.
- Former Executive at New Energy Ventures, the nation's largest non-utility electric retailer.
- Energy consultant to CPUC, USAID, and PowerPlus Corp. Member of Board of Directors at California Power Exchange Corporation.

• Nancy I. Day, Board Member

- Former Vice President, Regulatory Affairs at Southern California Gas Company
- Former Executive at New Energy Ventures. Energy Policy Consultant to California Assembly and State's Office of Ratepayer Advocates. Member, Los Angeles County Economic Development Corporation Board of Directors and chair of its Energy Task Force.

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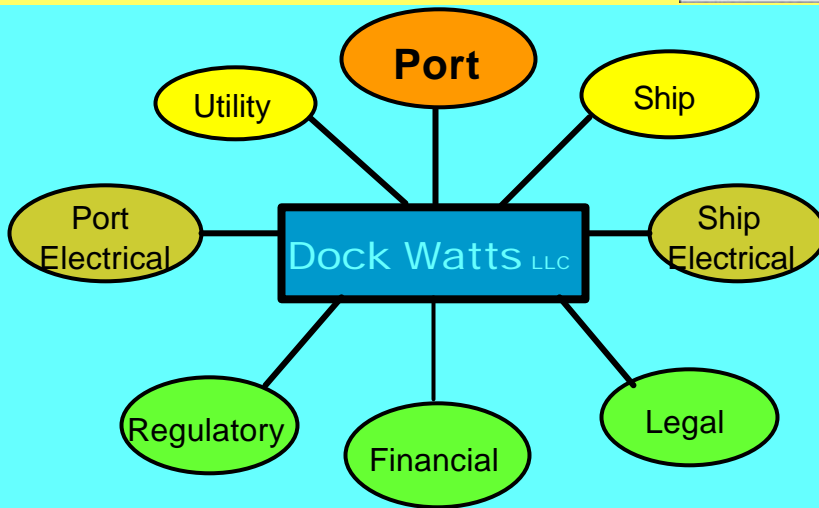
DOCK WATTS DEVELOPMENT MODEL



- **Select optimal candidates for shore power**
- **Refine design, costs, and operational requirements.**
 - ship on-board equipment; minimize cost, maximize portability
 - Connection between ship and port (cable management system)
 - Port/terminal electric facilities (distribution, utility interface)
- **Develop regulatory framework to capture value from Emission Reductions Credits.**
- **Create means to fund port and ship facilities.**
- **Power supply from regional grid under special tariffs with utilities or wholesale power wheeled to port.**

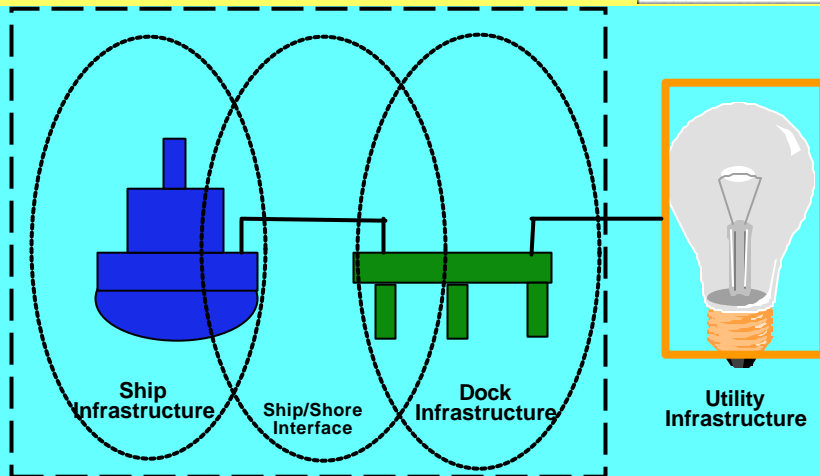
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THE ROLES IN SHORE POWER DEVELOPMENT



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COMPONENTS OF SHORE POWER



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NEED FOR A DIFFERENT PERSPECTIVE



- **Cannot look at “One-Off” Projects**
 - Existing projects have considered one terminal, one set of ships
 - Electrified ships could call on more than one shore power Port
- **Expansion improves Capital Utilization over time**
- **Incremental Cost Effectiveness of next project**
- **Key Economic Criteria (lb/MWh Emissions Driven)**
 - Berth Occupancy with electrified ships (hours/year)
 - Electric Loads (MW)
 - Port Call Duration (hours)

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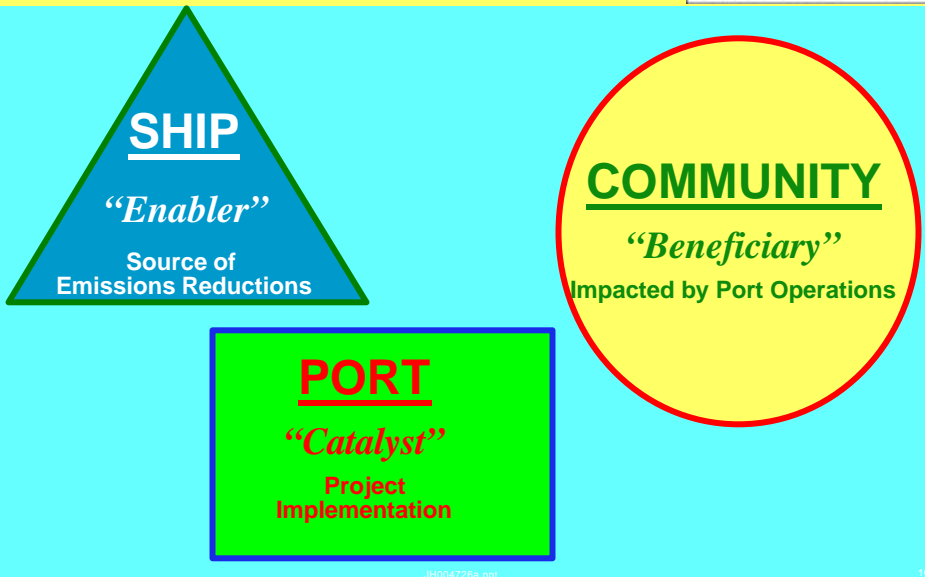
PORT COMMUNITY AIR QUALITY CONSIDERATIONS



- **Emissions Density**
 - Emissions intensity relative to point of source
 - Emissions concentration
- **Emissions Dispersion**
 - Comparing emissions from 20 miles out at sea to in-port sources
 - Impacts on Port communities vs communities 20 miles away
- **Balancing Impacts & Benefits from Port Activities**
 - Regional and National benefits from Port Commerce
 - Impacts and Mitigation measures need to be balanced
 - Cost of mitigation should go beyond port Port Community

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WHO IS THE DRIVER OF SHORE POWER ?



SOLUTION REQUIRES POLICY LEADERSHIP



- **Ports can set rules for ships to use Shore Power**
 - Establish fees for cost recovery
 - Create incentives for shore power adoption
 - Optimize value of emissions reductions and power supply
 - Adopt standards among other Ports and shipping lines
 - **Regulatory Agencies and Utilities can rally to support Port efforts to clean up air.**
 - **Everyone needs to have some skin in the game. Community, Marketplace, Regulators, Ports and Ships all participate in making things happen.**
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SHORE POWER MARKET ADOPTION



- **Similar to Cell Phone Model**
 - High early per unit costs, slow market adoption
 - Early users were given phones for usage commitments
- **Early Shore Power will require subsidies**
 - Government grants and loan guarantees
 - Subsidies to ships for on-board capital investment
 - Subsidies for power costs associated with shore power
- **Long-term, as ships and ports adopt shore power;**
 - Economics will improve
 - Costs will come down

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BALANCING SHORE POWER COSTS



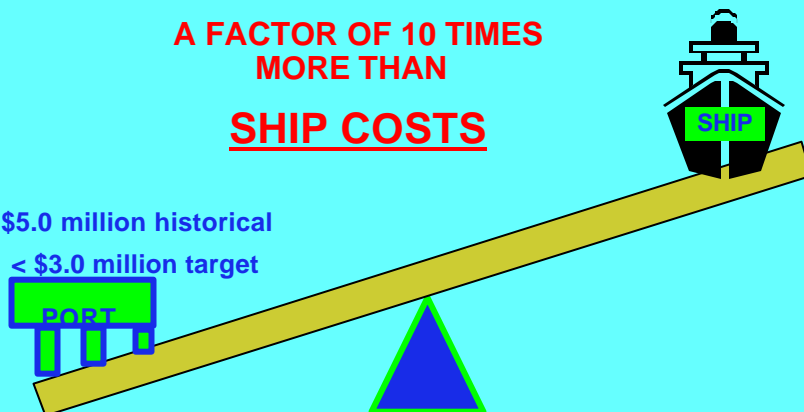
PORT COSTS

\$500,000 historical
< \$250,000 target

A FACTOR OF 10 TIMES
MORE THAN

SHIP COSTS

\$5.0 million historical
< \$3.0 million target



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WHO WILL PAY FOR SHORE POWER



- **Ships should be economically and financially indifferent to shore power**
 - Ship on-board cost subsidized by other funding sources
 - Ship cost of power no more than avoided on-board generation
- **Ports and Community need to develop means to fund port and ship capital infrastructure**
 - Monetized value of Emission Reduction Credits
 - Port Fees (cargo volume or passenger based)
 - Incentive structures (discounts to ships that use shore power)
 - Government backed financing structures, long term debt

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WHO WILL OWN EMISSIONS REDUCTIONS CREDITS



- **GOLDEN RULE:** *Who pays for it, should own it*
- **Should shore power be mandated or be a voluntary/market driven program?**
- **Would ERCs be considered mobile source credits or stationary source credits, or both?**
- **How will emissions reductions be verified?**
- **If Ports build it, will electrified ships come?**
- **Will Community benefit if ERCs are traded?**

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POWER SUPPLY OPTIONS



- **DISTRIBUTED GENERATION**
 - Dockside portable generators
 - Barge power along side ships in port or at moorings
- **PORT BASED CENTRAL PLANT**
 - Port electric distribution system operations
 - Port integrated operations with local power grid
- **GRID BASED POWER SUPPLY**
 - Interconnect with local distribution utility
 - Innovative utility rates for low cost power to serve shore power load
 - Wholesale power supply with transmission wheeling

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ESTIMATED EMISSIONS REDUCTIONS

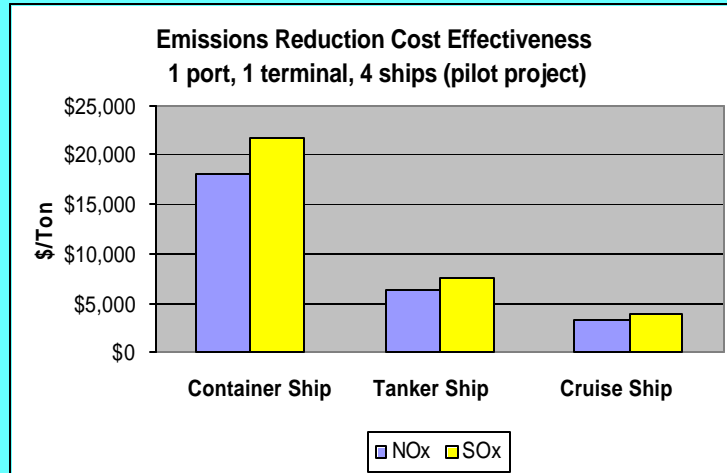


OPERATIONS ASSUMPTIONS		Port Call Frequency	Port Calls	Average *	Estimated	Average *	
		Days	Per Year	Hours in Port	Hours per Year	Electric Load	
						MW	MWh/Year
Container Ship		45	8	42.80	347	0.976	339
Tanker Ship		15	24	30.16	734	1.330	976
Cruise Ship		7	26	10.47	273	7.000	1,911
EMISSIONS FACTORS (grams/kWh)			NOx	SOx	CO2	HC	PM
Marine Aux Generators, Residual Fuel Oil **			14.70	12.30	722.00	0.40	0.80
		* Data Source: June 2004 Port of Los Angeles Emissions Inventory					
		** Data Source: July 2002 ENTEC Report prepared for the European Community					
		Assumes auxiliary generators are medium speed engines					
EMISSIONS FACTORS (lb/MWh)			NOx	SOx	CO2	HC	PM
Marine Aux Generators, Residual Fuel Oil			32.4	27.1	1591.7	0.9	1.8
New Power Plant (2x1 F Comb Cyc, nat. gas)			0.126	0.008	151.741	0.069	0.026
		* 2x1 F emission based on Siemens Westinghouse 501 F gas turbines					
SHIP EMISSIONS IN PORT (Tons/Year)			NOx	SOx	CO2	HC	PM
Container Ships Aux Generators, Residual Fuel Oil			5.5	4.6	270	0.149	0.299
Tanker Ships, Residual Fuel Oil			15.8	13.2	777	0.430	0.861
Cruise Ships Aux Generators, Residual Fuel Oil			31.0	25.9	1,521	0.842	1.685

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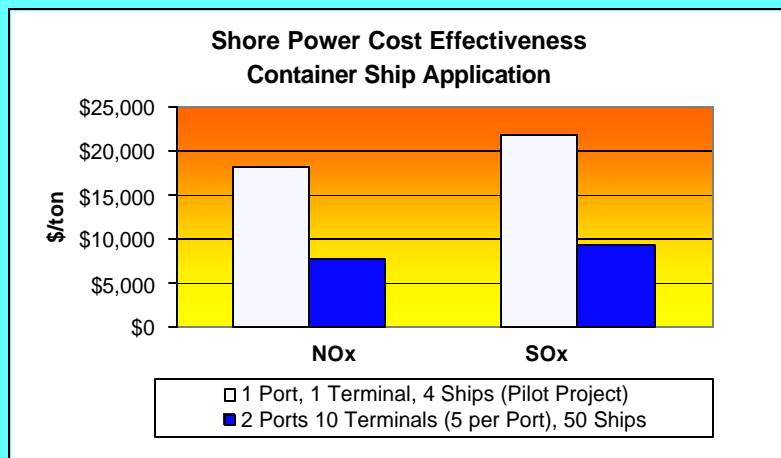
SHORE POWER COST EFFECTIVENESS



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COST EFFECTIVENESS MULTIPLE PORTS, MORE SHIPS



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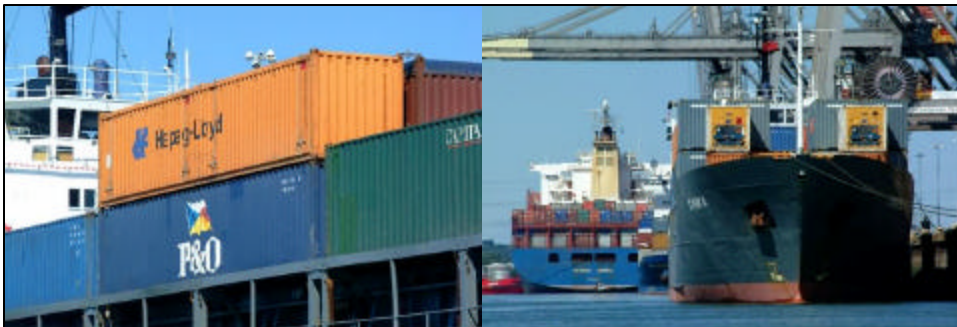
CHARTING A PATH TO SHORE POWER SUCCESS



- PORT AUTHORITY LEADERSHIP
- STANDARDIZE DESIGNS
 - Minimal impact to ship operations
 - Flexible-low cost ship connection
 - Low cost electric energy supply (wholesale power + delivery)
- SHIP OWNERS COOPERATION
- UTILITY COOPERATION
- AIR QUALITY AND OTHER REGULATORY AGENCIES
- COMMERCIAL AND FINANCIAL STRUCTURES
- COMMUNITY BENEFIT AND GOOD WILL

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